Laguna Madre
Port Isabel to Mud Flats, Vicinity of Mile 660
GIWW Stations 45+000 to 65+000

Alternative Dredging and Placement Cost Estimates

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Summary

Purpose and Scope of Work:

This study has been prepared by Gahagan & Bryant Associates, Inc., a Subcontractor to Espey, Huston & Associates, Inc. of Austin, Texas, in accordance with the Subcontract Agreement dated July 8, 1997 and in connection with Contract No. DACW64-94-D-0006 which EH&A has contracted with the U. S. Army Corps of Engineers

The purpose of this study is to provide cost estimates for various maintenance dredging alternatives from an identified shoal in the Port Isabel to Corpus Christi bay reach of the Gulf Intracoastal Waterway (GIWW) The various cost estimates involve both cutterhead pipeline and clamshell bucket dredges, and the transportation and placement of this material at different locations in the Laguna Madre Mud Flats vicinity The placement site options consist of open bay, Gulf offshore and near shore, beach and upland sites

The scope of work for these cost estimates included a meeting with the Galveston District Corps of Engineers to obtain available data from recent and past dredging projects, utilizing existing data to classify the types of material, and to compute the dredging volumes using available data to provide a detailed cost estimate and report.

Material Analysis:

The material is primarily silt with very soft mud and a small quantity of fine sand. Several of the alternatives envision using this material for beach fill and underwater berm construction The lack of coarse grain sands in the material to be dredged raises compatibility issues with respect to the native beach sands when used as beach fill. Hydraulic placement of this material via dredge pipelines would probably erode more of the existing beach than would be created This lack of characteristics usually found in structural fill does not readily lend itself to underwater berm construction. This material will probably create water quality concerns when pumped on the beach or bottom dumped from barges near shore.

Production Rates and Dredging Time:

The hourly production rates and daily operating time were derived from previous dredging history of the GIWW in the Laguna Madre for cutterhead pipeline dredges The hourly production rates and operating time were adjusted, as necessary, to reflect the installation and removal of submerged pipelines and booster pumps There are no previous clamshell dredging records available for the GIWW in this area The hourly production rates and daily operating time for bucket dredging were estimated from comparable projects in other geographic locations

Costs:

The estimated costs include the costs of performing the work (dredging and placement), mobilization and demobilization, and the cost for dike construction (placement area preparation). A summary of the project costs with the selected equipment and with placement as upland, open bay, offshore, near shore and beach placement are shown in Table 1, entitled Summary of Alternatives, on page 4.

Market Factors:

The costs estimated herein are based on contractor's costs and assume a fair and reasonable return to the contractor for his efforts. The dredging market for the last half of fiscal year 1997 has experienced an upward trend due mainly to the effects of the Federal funding cycle and scheduling, and from increased workload and availability of dredge plants. The bid prices at this time may be higher than previously advertised projects in this area Also, the smaller dredging quantity may not be attractive to some of the larger dredging contractors due to noncompetitive mobilization and operating costs associated with large dredges on small projects.

Conclusions:

There should be cutterhead pipeline dredges available to bid on this project None would be eager to work with a floating pipeline placing material in the near shore berm site in the Gulf of Mexico. The alternatives that utilize pipeline lengths greater than 25,000 to 30,000 feet may tend to reduce competition, resulting in increased cost for the project. Smaller dredging contractors normally do not have large pipe inventories and have problems justifying large ownership costs on small projects It may be difficult to get a clamshell bucket dredge bid due to the current lack of bucket dredges and scow barges on the Gulf Coast.

Recommendations:

The thirteen alternatives can be characterized in three basic cost groups Group One consists of four alternatives 1(A), 2(B), 4(D) and 7(L) and appear to be the more cost-effective solutions to dredging the shoal. The current method 1(A) is naturally the most cost-effective approach due to the short pumping distance and easy access to the placement areas Alternatives 2(B), 4(D) and 7(L) are basically equal in the cost-effective category and may need more detailed investigation and evaluation. Group Two consists of five alternatives 3(C), 8(M), 9(N), 10(O) and 13(S) and are at the next higher level of cost-effectiveness Group Three consists of the four remaining alternatives 5(I), 6(K), 11(Q) and 12(R) and would be the least desirable methods from a cost-effective viewpoint.

Group One alternatives have historically been the more commonly used dredging practices for removing shoals in this section of the GIWW with 1(A) being the most cost-effective and commonly used alternative The remaining three alternatives 2(B), 4(D) and 7(L) are essentially equal in cost and also commonly used dredging methods for this area Bid prices should be competitive for this type of dredging.

Group Two consists of five alternatives, all of which are less commonly used practices for dredging in this area. Alternatives 3(C), 10(O) and 13(S): because of the long submerged pipeline lengths and booster pumps, and 8(M) and 9(N)· because of the long pipeline lengths and placement of this type of material as beach fill. These methods of dredging reduces competition which results in higher and more variable bid prices.

Group Three consists of the four remaining alternatives which are all highly uncommon methods for dredging shoals in the GIWW. Alternatives 5(I) and 6(K) because of the shallow draft conditions and lack of available equipment; and 11(Q) and 12(R): because of the extremely long submerged pipelines and multiple booster pumps Due to the high degree of difficulty and uncertainties involved in these methods of dredging, it will be questionable as to the ability to secure bids for the project.

Further refinement of these estimates would require detailed field investigations including, but not limited to, geotechnical investigations, hydrographic and topographic surveys of pipeline routes, haul routes and proposed placement sites.

Due to the mobilization and pipeline handling costs associated with some of the alternatives and the small size of the project, some reduction in unit prices could occur through economy of scale if this reach is included in the maintenance dredging contract of other reaches of the GIWW as is currently practiced.

Another alternative that should be evaluated would be to dredge with a clamshell, haul and dump the material in a remote area of Port Isabel Harbor and rehandle with a small relatively inexpensive pipeline dredge to Placement Area 241 or Long Island This method would reduce the idle and standby cost of a barge pumpout unit and also decrease the unloading time for the scow barges

Table 1
Summary of Alternatives
GIWW Stations 45+000 - 65+000
699,612 Pay Cubic Yards; 874,500 Gross Cubic Yards

Alternative		Time Required Days	Production Rate: Pay CY/Day	Mob. and Demob. Cost	Placement Area Cost	Dredge Pipeline Cost	Operating Cost	Ownership Cost	Total Cost	Total Unit Cost
1(A)		27 0	25,912	$204,138	$0	$0	$333,202	$222,135	**$759,475**	$1 09
2(B)		31 2	22,423	$249,138	$0	$155,000	$514,755	$343,170	**$1,262,063**	$1.80
3(C)		34 1	20,516	$271,638	$0	$250,000	$660,073	$440,048	**$1,621,759**	$2 32
4(D)		31.2	22,423	$271,638	$0	$165,000	$518,216	$345,478	**$1,300,332**	$1.86
5(I)	*	146 0	4,792	$237,000	$0	$0	$1,751,651	$1,171,768	**$3,160,419**	$4.53
6(K)	*	167 0	4,189	$237,000	$0	$0	$2,010,465	$1,340,310	**$3,587,775**	$5 13
7(L)		34.2	20,456	$249,138	$0	$105,000	$530,978	$353,986	**$1,239,102**	$1 77
8(M)	**	36 5	19,167	$324,138	$0	$365,000	$819,120	$546,080	**$2,054,338**	$2 94
9(N)	**	34 2	20,456	$294,138	$0	$315,000	$667,700	$445,133	**$1,721,971**	$2.46
10(O)		34 2	20,456	$271,638	$298,358	$275,000	$660,111	$440,074	**$1,945,181**	$2.78
11(Q)	*	44 8	15,616	$399,138	$213,360	$525,000	$1,287,856	$858,571	**$3,283,925**	$4 69
12(R)	*	44 8	15,616	$399,138	$265,300	$525,000	$1,287,856	$858,571	**$3,335,865**	$4 77
13(S)	**	32 2	21,727	$271,638	$265,870	$235,000	$614,363	$409,575	**$1,796,446**	$2 57

Notes: * Questionable ability to secure competitive bids

** Material not suitable for this type of placement

1.0 Introduction

Gahagan & Bryant Associates, Inc entered into an agreement to perform consulting engineering services for the purpose of providing cost estimates for a number of maintenance dredging alternatives to remove shoals from the "Port Isabel to Mud Flats" reach of the Gulf Intracoastal Waterway GIWW between stations 45+000 to 65+000, vicinity of Mile 660. Due to the sensitive environmental resources of the area, thirteen separate placement areas will be addressed with cost estimates provided for each of the thirteen alternatives.

1.1 Purpose and Scope

The purpose of this work is to provide cost estimates to aide in the evaluation of various maintenance dredging alternatives for an identified shoal in the Port Isabel to Corpus Christi Bay reach of the GIWW near Mile 660. The scope of work consists of removing 699,612 cubic yards of maintenance material from the "Port Isabel to Mud Flats" reach of the GIWW between channel stations 45+000 to 65+000 by cutterhead pipeline and/or clamshell bucket dredging, and placing this material in one of the thirteen material placement area alternatives·

1(A) This alternative calls for the shoal in the channel to be maintained using a cutterhead pipeline dredge and placing the material in adjacent areas 233 and 234

2(B) This alternative involves placing the material removed from the shoal by cutterhead dredge to the nearest placement area north of the shoal, Placement Area 232. No dike construction or placement area preparation is required.

3(C)· This alternative involves placing the shoal material dredged by cutterhead dredge to the second placement area north of the shoal, Placement Area 231 No dike construction or placement area preparation is required.

4(D): This alternative involves placing of the material removed from the shoal by cutterhead dredge to the nearest placement area south of the shoal, Placement Area 235 This alternative does not call for any site work at the placement area

5(I). This alternative involves dredging by clamshell, transporting dredged material by barge and placing into the ocean placement area currently approved for the Brazos Island Harbor (B I H) entrance channel.

6(K) This alternative would use the dredged material to create a submergent berm to absorb wave energy and decrease shoreline erosion. Placement could be accomplished by barge or pipeline

7(L): This alternative uses a bottom discharge placement method to increase the elevation of the bay bottom to a level that would support new seagrass growth

8(M): This alternative involves placement of the material removed from the shoal by cutterhead pipeline dredge to the beach north of the BIH entrance channel.

9(N): This alternative calls for the material removed from the shoal by cutterhead pipeline dredge to be placed on the beach on the east side of Padre Island immediately east of station 55+000.

10(O): This alternative involves placement of the material removed from the shoal by cutterhead dredge to a new placement area on Padre Island immediately east of station 55+000 The area will require dikes, spillways and inside slope protection.

11(Q) This alternative involves the most economical of two alternatives· dredging by cutterhead and pumping the material to Placement Area 241, or removal by clamshell and barging the material to Placement Area 241. This area requires dike and spillway repairs and new dike construction

12(R)· This alternative is similar to Alternative 11(Q), but uses a new placement area on the south end of Long Island. This area requires new dikes and a spillway.

13(S): This alternative calls for the reach to be maintained using a cutterhead dredge with placement in a new site at a development area in Holly Beach. This area is on the mainland west of the shoal area and would require new dikes and a spillway

1.2 Project Description

This section of the GIWW is a 12-foot-deep by 125-foot-wide project channel that extends 117 miles from Corpus Christi Bay to Port Isabel through the Laguna Madre The project consists of maintenance dredging 699,612 cubic yards of pay quantity evenly distributed in the GIWW between channel stations 45+000 to 65+000 and transporting it to the identified dredged material placement areas by the method described for each of the thirteen alternatives.

1.3 Geographic Location

The project is located on the western shore of the Gulf of Mexico near Mile 660 of the GIWW It is approximately 100 miles south of the Port of Corpus Christi, Texas and approximately 30 miles north of the Port of Brownsville, Texas

1.4 Assumptions

The following assumptions were made concerning the dredging and placement of the shoal material in the cost estimate

(1) All necessary dredge pipeline rights-of-way will be obtained

(2) All upland placement easements have been obtained.

(3) Placement Areas 231, 232, 233, 234 and 235 are unconfined areas and no retaining dikes are required.

(4) Culverts are available or will be provided for pipeline rights-of-way to the beach when crossing existing streets and highways

(5) Clear navigation depth from the dredge site to the placement area exists for bottom dump barges loaded to a draft of 11 feet MLT

(6) Beach placement areas are considered unconfined placement areas

(7) Fuel prices are estimated at $0.75 per gallon

(8) Retaining dikes can readily be constructed using in situ material with no foundation concerns at new upland placement areas at Holly Beach, Long Island and Padre Island

(9) Submerged pipelines (sublines) may be layed to all the existing placement sites used for cutterhead pipeline dredging using conventional techniques

(10) Traffic and weather delays for the clamshell dredging and barge haul will be minimal

(11) Due to the characteristics of the shoal material, no overflow will be allowed when loading scow barges

(12) Engineering, administration, permitting and supervision costs are not included

(13) Water quality requirements are adjusted to meet the dredging, transport and placement technique utilized for a particular alternative

(14) Dragging or leveling placement area for alternative 7(L) will not be required.

(15) The material is primarily silt and very soft mud.

2.0 Production Analysis

This section of the GIWW is a 12-foot-deep by 125-foot-wide project. The channel is dredged to -14.0 feet Mean Low Tide (MLT) required depth, for advanced maintenance, and a 2-foot allowable, paid overdepth with 1-foot vertical on 3-foot horizontal side slopes. The shoal area covers 20,000 feet from stations 45+000 to 65+000

(1) Estimated pay quantity = 699,612 cy. 699,612 cy ÷ 20,000 feet = 35 cy/ft. The pay quantity is the limiting amount of material which will be measured and paid for when excavated from the prescribed contract template.

(2) The estimates used a factor of 25% for nonpay or gross dredging. This is material that is dredged beyond the limits of contract template due to the physical constraints of the dredging process 699,612 pay cy x .25 = 174,888 cy of nonpay dredging.

(3) The total dredge quantity for each alternative is 874,500 cy 874,500 cy ÷ 20,000 ft = 44 cy/ft. This quantity is significant because it represents the total amount of material excavated and transported to the placement site and is used to determine capacity requirements for confined placement, as well as the time required to perform the work

(4) The material is primarily silt and very soft mud with a small amount of fine sand Historically, maintenance dredging of this channel has been by cutterhead pipeline dredges and pumped into adjacent open water placement areas along the channel The dredges have varied in size from 16" to 27" and have operated on less than 3,000 feet of pipeline with a minimum amount of power, 2000 HP or less

Since there are a number of alternatives which require long pipelines and booster pumps, a 24" or 27" equivalent size dredge is estimated for hydraulic cutterhead dredging and a 12-cubic-yard clamshell dredge for mechanical dredging. The history for 24" or 27" cutterhead dredges operating under these similar conditions indicates an hourly production capacity of 1800 cubic yards per hour and 18:00 hours per day operating time The production rate of 1800 cy/hr or any other hourly production rate used in this report to compute dredging time is based on total dredged quantity or gross quantity dredged per hour The operating time per day is reduced one hour per day to consider the effects of handling submerged pipelines, and one additional hour per day for delays associated with each booster pump. The cubic yard per hour production rate is reduced as the pipeline increases and also at times when boosters and pipelines are added in different combinations.

Cubic yards per hour (less than 3,000 ft pipeline)	=	1800 cy/hr
Operating time per day (without subline)	=	18:00 hrs/day
Operating time per day (with subline)	=	17 00 hrs/day
Operating time per day (with subline and 1 booster)	=	16 00 hrs/day

(5) A 12-cubic-yard clamshell dredge and two each 2000 and 4000-cubic-yard scow barges were selected primarily because of the availability of this type of equipment on the Gulf Coast. The production rates for these scenarios will be at approximately 50% of capability due to draft restrictions on the barges and towing vessels, light loading, no overflow and the silty fluid type of material to be dredged. With the above restrictions, the cubic yards per barge load will be as follows:

1	4000 cy Scow Barge	(11-foot draft)		2000 cy/load
1	4000 cy Scow Barge	(11-foot draft)		2000 cy/load
1	2000 cy Scow Barge	(11-foot draft)		1000 cy/load
1	2000 cy Scow Barge	(11-foot draft)		1000 cy/load
4	each loads			6000 cy
Average cubic yards per barge load			=	1500 cy

Generally, the average cycle time of a 12-cubic-yard clamshell dredge is 68 seconds per bucket. Using 50 working minutes per hour:
50 working min/hr x 60 seconds/minute ÷ 68 seconds/bucket = 44 1 buckets/hour
Using a 12-cubic-yard bucket and considering the silty, fluid material and a small vertical face at times the average bucket load would be three-fourths full or 75% loaded

12 cy clamshell x 75% loaded		=	9 cy/bucket
44.1 buckets/hour x 9 cy/bucket		=	397 cy/hour
Average operating time per day		=	19.00 hrs/day
Average daily production. 19 hrs/day x 397 cy/hr		=	7,543 cy/day
	say	=	7,500 cy/day

(6) For Placement Area 241 and Long Island
Use 5 each barge loads per day x 1500 cy/barge = 7,500 cy/day

(7) For offshore placement, use 4 each barge loads per day due to the added travel distance and time to the placement area·
4 each barge loads per day x 1500 cy/barge = 6,000 cy/day

(8) For near shore (underwater berm) placement, use 3.5 barge loads per day due to the added travel time and also positioning time at the berm location:
3.5 each barge loads per day x 1500 cy/barge = 5,250 cy/day

2.1 Time Required (Dredge Days)

The following are the thirteen alternative methods of removing the shoal and the dredging time required for each alternative The time required, or dredge days, for each alternative is computed by dividing the production rate for the alternative into the dredge quantity to obtain the total hours required; then divide the daily operating time for the alternative into the total hours to obtain the dredge days

1(A) *Current Method.* Use cutterhead pipeline dredge and pump into adjacent Placement Areas 233 and 234 with no dike cost Total pipeline. 1000 to 2000 ft

Operating time per Day	=	18.00	hrs/day
Cubic Yards per Hour	=	1800	cy/hr
874,500 cy ÷ 1800 cy/hr ÷ 18.00 hrs/day	=	27 0	days

2(B) *Unconfined Method·* Use cutterhead pipeline dredge and pump north to Placement Area 232 with no dike repair cost. Minimum pipeline 10,000 feet and maximum pipeline 26,000 feet

Operating time per Day, 18 hours - 1 hour	=	17·00	hrs/day
Deduct one hour per day for handling subline and deduct one additional hour per day when booster is added in pipeline	=	16·00	hrs/day
Cubic Yards per Hour	=	1700	cy/hr
Dredging Time: Use one-half the yardage without a booster and one-half with one booster			
437,250 cy ÷ 1700 cy/hr – 17·00 hrs/day	=	15 1	days
437,250 cy ÷ 1700 cy/hr – 16:00 hrs/day	=	16 1	days
Total	=	31.2	days

3(C) *Unconfined Method·* Use cutterhead pipeline dredge and pump north to Placement Area 231 with no dike repair cost. Minimum pipeline is 19,000 feet and maximum pipeline is 36,000 feet Deduct one hour per day for handling subline and deduct one hour per day for one booster in line.

Operating time per Day = 18:00 hours - 2:00 hours	=	16.00	hrs/day
Cubic Yards per Hour	=	1600	cy/hr
874,500 cy ÷ 1600 cy/hr – 16:00 hrs/day	=	34 1	days

4(D) *Unconfined Method·* Use cutterhead pipeline dredge and pump south to Placement Area 235 with no dike repair cost. Minimum pipeline 10,000 feet and maximum pipeline 28,000 feet Deduct one hour per day for handling subline and one additional hour per day when booster is in line.

Operating time per Day 18 00 hours - 1 hour	=	17·00	hrs/day
Operating time with Booster 18 00 hours - 2 hours	=	16:00	hrs/day
Cubic Yards per Hour use	=	1700	cy/hr
437,250 cy – 1700 cy/hr – 17:00 hrs/day	=	15 1	days
437,250 cy ÷ 1700 cy/hr ÷ 16 00 hrs/day	=	16 1	days
Total:	=	31 2	days

5(I) *Gulf Placement by Scow Barge to Existing Placement Site.* This alternative involves clamshell dredging and transporting by scow barges to the placement area currently approved for the Brazos Island Harbor (BIH) entrance channel. The minimum one-way haul distance is 15 miles or 30 miles per trip The maximum one-way haul is 19 miles or 38 miles per round trip

The equipment available for this dredging would be: 2 each 4000-cubic-yard scows and 2 each 2000-cubic-yard scows, and a 12-cubic-yard clamshell bucket dredge. Due to the shallow draft of the GIWW, the scows would be light loaded to 1000 cubic yards for the 2000-cubic-yard scows and 2000 cubic yards for the 4000-cubic-yard scows. The average load would then be 1500 cubic yards per trip. Due to the draft restrictions along the travel route, the speed of the towing vessel will be less than optimum.

Use 4 loads per day as the average daily production:

4 loads x 1500 cubic yards per load	=	6000	cy/day
874,500 cubic yards ÷ 6000 cy/day	=	146	days

6(K) *Gulf Placement with Beneficial Use at a New Placement Site*· This alternative would use the dredged material to create a submergent berm to absorb wave energy and decrease shoreline erosion. This material is very silty and there are concerns that it will serve the intended purpose for such a small application. Ground swells and current could move this material from the berm site. The method selected for placing this material is a clamshell dredge with bottom dump scows. Berm construction utilizing a cutterhead pipeline dredge would have drastically reduced operating time and efficiency It would be very difficult to hold a pipeline in place and develop economic operating time in the open Gulf environment. Also, since the material is transported as a slurry and has long settlement times, it is unlikely that any berm or mound could be constructed with this technique. Equipment and operating conditions will be the same as alternative 5(I).

The average scow barge load would be 1500 cubic yards per load. The number of loads per day would be reduced to 3.5 due to additional time involved in positioning the scow in line with the berm and placing the material

Average Daily Production 3 5 loads/day x 1500 cy	=	5250	cy/day
874,500 cubic yards ÷ 5250 cy/day	=	167	days

7(L) *Open Bay Placement in a New Placement Area that has no Seagrasses* This alternative involves placement of the material removed from the shoal by cutterhead pipeline dredge and placed by a bottom placement method to increase the elevation of the bay bottom to a level that would support new seagrass growth An electronic positioned spill barge with a diffuser on the discharge end would be required to control the placement of this material Minimum pipeline is 10,000 feet and the maximum pipeline is 18,000 feet. Deduct one hour per day for handling subline and one hour for delays associated with the spill barge

Operating time per Day is 18:00 hours - 2 hours	=	16:00	hrs/day
Cubic Yards per Hour	=	1600	cy/hr
874,500 cubic yards ÷ 1600 cy/hr ÷ 16 hrs/day	=	34 2	days

8(M) *Beach Placement at an Existing Beach Placement Site by Pipeline·* This alternative involves placement of the material removed from the shoal by cutterhead pipeline dredge to the beach north of the BIH entrance channel. The shoal material is primarily silt with some very soft mud This material will not build up any kind of beach fill and could possibly erode more beach than it will build The minimum pipeline length is 32,000 feet and the maximum pipeline is 46,000 feet. Deduct one hour per day for handling subline and one hour per day for each booster in the line.

Operating time with 1 Booster 18.00 hours - 2 hours	=	16 00	hrs/day
Operating time with 2 Boosters 18:00 hours - 3 hours	=	15·00	hrs/day
Cubic Yards per Hour (1 Booster)	=	1600	cy/hr
Cubic Yards per Hour (2 Boosters)	=	1500	cy/hr
437,250 cubic yards − 1600 cy/hr ÷ 16 hrs/day	=	17 1	days
437,250 cubic yards ÷ 1500 cy/hr − 15 hrs/day	=	19 4	days
Total	=	36.5	days

9(N) *Beach Placement at a New Beach Placement Site by Pipeline* This alternative involves placement of the material removed by cutterhead pipeline dredge to the beach on the east side of Padre Island, immediately east of channel station 55+000 The shoal material is silt and very soft mud, and will not form any kind of typical beach fill. There will probably be turbidity and water quality concerns which are not estimated for in the operating time and production Minimum pipeline length is 29,000 feet and the maximum pipeline is 39,000 feet Deduct one hour per day for handling subline and one hour per day for each booster in the line.

Operating time with 1 Booster 18 00 hours - 2 hours	=	16.00	hrs/day
Cubic Yards per Hour with 1 Booster	=	1600	cy/hr
874,500 cubic yards − 1600 cy/hr ÷ 16 hrs/day	=	34.2	days

10(O) *Upland Placement Site on Padre Island* This alternative involves placement of material removed from the shoal by cutterhead pipeline dredge to a new confined placement area on Padre Island, immediately east of channel station 55+000. Approximate size of placement area would be 180 acres with a 7-foot high dike and one spillway. Since the dike material is 100% sand, the dikes will require visqueen around the complete inside slope The minimum pipeline length is 25,000 feet and the maximum pipeline is 35,000 feet For estimated operating time per day, deduct one hour for handling subline and one hour for each booster in the line.

Operating time per Day 18·00 hours - 2 hours	=	16:00	hrs/day
Cubic Yards per Hour with 1 Booster	=	1600	cy/hr
874,500 cubic yards − 1600 cy/hr ÷ 16 hrs/day	=	34 2	days

11(Q) *Upland Placement at Placement Area 241:* This alternative involves the most economical of two alternatives: dredging by cutterhead pipeline dredge and pumping the material to Placement Area 241; or removal of material by clamshell and barging the material to Placement Area 241 and pumping out Placement Area 241 will require dike repairs. Due to the availability and cost of hopper barges and barge pumpout units, the cutterhead pipeline method is more economical than the clamshell method.

The minimum pipeline length is 45,000 feet and the maximum pipeline length is 65,000 feet For operating time per day, deduct one hour per day for handling sublines and one hour per day for each booster in the line.

Operating time/Day with 2 Boosters 18:00 hrs - 3 hrs	=	15 00	hrs/day
Operating time/Day with 3 Boosters 18.00 hrs - 4 hrs	=	14.00	hrs/day
Cubic Yards per Hour with 2 Boosters	=	1400	cy/hr
Cubic Yards per Hour with 3 Boosters	=	1300	cy/hr
Use 2 Boosters for half the yardage and 3 Boosters for remaining half of yardage:			
437,250 cubic yards ÷ 1400 cy/hr ÷ 15.00 hrs/day	=	20.8	days
437,250 cubic yards ÷ 1300 cy/hr ÷ 14:00 hrs/day	=	24 0	days
Total	=	44.8	days

12(R) *Upland Placement at South End of Long Island* This alternative is similar to Item 11(Q) but uses a new placement area on the south end of Long Island. Again, the most economical method of dredging will be by cutterhead pipeline dredge due to the availability and cost of scow/hopper barges and pumpout units. There will be new dikes constructed at the Long Island placement site. The site will be approximately 200 acres and have 7-foot dikes with 10-foot crown and 1 on 3 side slope. The material will be semicompacted. One spillbox is estimated for the area. The pipeline lengths, booster locations, operating time and hourly production rates are the same as Placement Area 241

437,250 cubic yards – 1400 cy/hr ÷ 15:00 hrs/day	=	20.8	days
437,240 cubic yards ÷ 1300 cy/hr ÷ 14:00 hrs/day	=	24 0	days
Total	=	44 8	days

13(S) *Upland Placement at a New Mainland Placement Site:* This alternative calls for the reach to be maintained using a cutterhead dredge with placement in a new placement area on the mainland at a development area in Holly Beach just south of Laguna Atascoa National Wildlife Refuge This new placement site is approximately 180 acres. The new dikes would have a 7-foot height with 10-foot crown and 1 on 3 side slopes There would be one spillbox constructed in the area. The minimum pipeline length is 21,000 feet and the maximum pipeline is 31,000 feet. For operating time per day, deduct one hour for handling sublines and one hour for each booster in the line.

Operating Time/Day with 1 Booster 18·00 hrs - 2 hrs	=	16.00	hrs/day
Cubic Yards per Hour with 1 Booster	=	1700	cy/hr
874,500 cubic yards – 1700 cy/hr – 16 hrs/day	=	32 2	days

3.0 Alternative Cost Estimates

1(A) *Current Method.*

(1) Mobilization and Demobilization - Use 400 miles as location to job site. Dredge tenders will be used as assist boats for towing vessels

(a)	400 miles ÷ 3.5 miles/hr. − 24 hrs	=	4.8 days		
(b)	Lock delays		1.2 days		
(c)	Weather delays		1.0 days		
	One-Way Trip	=	7.0 days		
(d)	Towing vessels return to base	=	3.0 days		
(e)	Use 2 tugs for dredge and attendant plant; towing vessel is $2,400/day				
(f)	Towing cost $2,400/day x 2 ea x 10 days	=	$ 48,000		
(g)	Dredge and attendant at 50% cost while mob. $15,475/day x 5 x 7 days	=	54,163		
(h)	One day to set up dredge at full rate	=	15,475		
(i)	Overhead on items (g) and (h) at 15%	=	10,446		
(j)	Profit on items (g), (h), and (i) at 10%	=	8,008		
	Mobilization Cost		$136,092		
(k)	Use 50% for Demobilization		68,046		
(l)	Mobilization and Demobilization	L.S.			$204,138

(2) Pipeline L.S. = -0-

(a) No additional pipelines necessary other than with the dredge and attendant plant.

(3) Dikes, Spillways and Ditches L.S. = -0-

(a) No dikes, spillways or ditches required for this alternative

(4) Dredging GIWW Station 45+000 to 65+000· 699,612 pay cy

(a)	Dredging time is 27.0 days				
(b)	Daily dredging cost is $15,475/day				
(c)	$15,475/day x 27 days		=	$417,825	
(d)	Overhead - 15%		=	62,674	
		Subtotal		$480,499	
(e)	Contingency - 5%		=	24,025	
(f)	Profit - 10%		=	48,050	
		Subtotal		$552,574	
(g)	Bond - 0.5%		=	2,763	
(h)	Dredging Unit Price =	$0.83 cy			$555,537
		Total Alternative 1(A)			$759,475
		Total Unit Price 1(A):			$1.09 cy

2(B) *Unconfined Method.* Use Cutterhead Pipeline Dredge and Pump North to Placement Area 232

(1)	Mobilization and Demobilization					
	(a)	Mob and demob dredge and attendant plant	=	$204,138		
	(b)	Maximum pipeline 26,000' - 5,000' with dredge = 21,000 feet of additional line. Assume pipeline is built on jobsite; therefore no additional mobilization cost.				
	(c)	Demob subline, use 400 miles ÷ 4MPH = 100 hrs Towing vessel $100/hr and tender boat $50/hr 100 hours x $150/hr. x 2 tows	=	30,000		
	(d)	50 hours light boat one-way and return to base 50 hours x $150/hr. x 2 tows	=	15,000		
	(e)	Total Mobilization and Demobilization	L.S.			$249,138
(2)	Pipelines					
	(a)	Maximum pipeline is 26,000' - 5,000' with dredge = 21,000 feet of additional line for alternative.				
	(b)	Install 10,000 feet of subline to start dredging 10,000 feet @ $5.00/ft.	=	$50,000		
	(c)	Pick up 21,000 feet of subline at completion 21,000 feet @ $5.00/ft	=	105,000		
	(d)	Total Pipelines	L.S			$155,000
(3)	Dikes, Spillways and Ditches		L S		=	-0-
(4)	Dredging GIWW Stations 45+000 to 65+000: 699,612 pay cy					
	(a)	Dredging time for dredge is 31 2 days $15,475/day @ 31.2 days	=	$482,820		
	(b)	Booster $5,720/day @ 16 1 days	=	92,092		
	(c)	21,000 feet subline @ $2.00/ft./mo. x 31.2 days – 30	=	43,680		
		Subtotal		$618,592		
	(d)	Overhead - 15%		92,789		
		Subtotal:		$711,381		
	(e)	Contingency - 10%		71,138		
	(f)	Profit - 10%		71,138		
		Subtotal:	=	$853,657		
	(g)	Bond - 0 5%		4,268		
	(h)	Dredging Unit Price =	$1 23/cy			857,925
			Total Alternative 2(B)			$1,262,063
			Total Unit Price 2(B)			$1.80/cy

3(C) *Unconfined Method.* Use Cutterhead Dredge and Pump North to Placement Area 231

(1)	Mobilization and Demobilization				
	(a)	Dredge and attendant plant	=	$204,138	
	(b)	Maximum subline 36,000' - 5,000' with dredge = 31,000 feet of additional line. Assume pipeline will be built on site; therefore no mobilization			
	(c)	Demobilize subline - Use 400 miles -- 4MPH = 100 hrs x $150/hr. x 3 tows	=	45,000	
	(d)	50 hours light boat one-way 3 trips 50 hours x $150/hr x 3 trips	=	22,500	
	(e)	Total Mobilization and Demobilization	L S		$271,638
(2)	Pipelines				
	(a)	Maximum pipeline is 36,000' - 5,000' with dredge = 31,000 feet of additional line for alternative			
	(b)	Install 19,000 feet of subline to start dredging 19,000 feet @ $5 00/ft	=	$95,000	
	(c)	Pick up 31,000 feet of subline at completion 31,000 feet @ $5 00/ft	=	155,000	
	(d)	Total Pipelines	L S		$250,000
(3)	Dikes, Spillways and Ditches		L S.	=	-0-
(4)	Dredging GIWW Stations 45+000 to 65+000 699,612 pay cy				
	(a)	Dredging time for dredge and one booster is 34.1 days $15,475/day @ 34 1 days	=	$ 527,698	
	(b)	Booster $5,720/day @ 34 1 days	=	195,052	
	(c)	31,000' subline x $2 00/ft/mo x 34 1 days ÷ 30	=	70,473	
		Subtotal		$ 793,223	
	(d)	Overhead - 15%	=	118,983	
		Subtotal:		$ 912,206	
	(e)	Contingency - 10%	=	91,221	
	(f)	Profit - 10%	=	91,221	
		Subtotal		$1,094,648	
	(g)	Bond - 0 5%	=	5,473	
	(h)	Dredging unit price = $1 57/cy			$1,100,121
		Total Alternative 3(C)			$1,621,759
		Total Unit Price 3(C)			$2.32/cy

4(D) *Unconfined Method*· Use Cutterhead Pipeline Dredge and Pump South to Placement Area 235.

(1)	Mobilization and Demobilization				
	(a)	Dredge and attendant plant	=	$204,138	
	(b)	Maximum subline 28,000' - 5,000' with dredge = 23,000 feet of additional line. Assume no mobilization.			
	(c)	Demobilize subline - Use 400 miles ÷ 4 MPH = 100 hours x $150/hr x 3 tows	=	45,000	
	(d)	50 hours light boat one-way 3 trips 50 hours x $150/hr x 3 trips	=	22,500	
	(e)	Total Mobilization and Demobilization			$271,638
(2)	Pipelines				
	(a)	Maximum pipeline is 28,000' - 5,000' with dredge = 23,000 feet of additional line for alternative			
	(b)	Install 10,000 feet of subline to start dredging 10,000 feet @ $5.00/ft.	=	$50,000	
	(c)	Pick up 23,000 feet of subline at completion 23,000 feet @ $5.00/ft	=	115,000	
	(d)	Total Pipelines			$165,000
(3)	Dikes, Spillways and Ditches			L.S. =	-0-
(4)	Dredging GIWW Stations 45+000 to 65+000· 699,612 pay cy				
	(a)	Dredging time for dredge is 31.2 days Dredging time for booster is 16.1 days Dredge $15,475/day @ 31 2 days	=	$482,820	
	(b)	Booster $5,720/day @ 16.1 days	=	92,092	
	(c)	23,000 feet subline x $2 00/ft/mo. x 31 2 days ÷ 30	=	47,840	
		Subtotal		$622,752	
	(d)	Overhead - 15%	=	93,413	
		Subtotal:		$716,165	
	(e)	Contingency - 10%	=	71,616	
	(f)	Profit - 10%	=	71,616	
		Subtotal		$859,397	
	(g)	Bond - 0.5%	=	4,297	
	(h)	Dredging Unit Price = $1.23/cy			$ 863,694
		Total Alternative 4(D)			$1,300,332
		Total Unit Price 4(D)			$1.86/cy

5(I) *Offshore Placement*· Use Bucket and Dump Scows to Load and Haul to Existing BIH Placement Site.

(1) Mobilization and Demobilization

(a) Mob and demob will be estimated from the Louisiana Gulf Coast. This is the nearest possible location of this type of equipment (670 miles). Mobilize 2 each 4,000 cy and 2 each 2,000 cy scows, and 12 cy bucket dredge and attendant plant.

(b) One towing vessel will take two scows in a tandem tow:
670 miles − 5 MPH − 24 hours = 5.6 days, plus 1.4 days
(for preparation at start and stop location) = 7 0 days.

(c)	Towing vessel - Use $3,000/day per vessel			
	$3,000/day x 7 days x 2 tugs	=	$42,000	
(d)	4,000 cy scows during mob = $750/day			
	$750/day x 7 days x 2 each	=	10,500	
(e)	2,000 cy scows during mob = $500/day			
	$500/day x 7 days x 2 each	=	7,000	
(f)	Marine survey for trip	=	5,000	
(g)	Marine insurance for trip	=	10,000	
(h)	Bucket dredge 670 miles ÷ 100 MPD			
	= 6 7 days + 1.3 days (for preparation)			
	= 8 0 days x $2,500/day (bucket dredge mob)	=	20,000	
(i)	Towing vessel $3,000/day x 8 days	=	24,000	
	Total Mobilization.	=	$118,500	
(j)	Demobilization: No prospects for work in			
	area, therefore, charge demobilization	=	118,500	
(k)	Total Mobilization and Demobilization	L S.		$237,000

(2) Pipelines (Clamshell Bucket and Barges Method) N/A

(3) Dikes, Spillways and Ditches N/A

(4) Dredging GIWW Stations 45+000 to 65+000: 699,612 pay cy

(a)	Dredging time for 12 cy clamshell dredge is 146 days. The average roundtrip haul is 34 miles The scows are light loaded due to draft restrictions				
(b)	Daily cost for dredge and attendant plant, scows and towing vessels $14,230/day @ 146 days	=	$2,077,580		
(c)	Overhead - 15%	=	311,637		
	Subtotal:		$2,389,217		
(d)	Contingency - 12%	=	286,706		
(e)	Profit - 10%		238,922		
	Subtotal		$2,914,845		
(f)	Bond - 0 5%	=	14,574		
(g)	Dredging Unit Price =	$4.19/cy			$2,929,419
		Total Alternative 5(I).			$3,166,419
		Total Unit Price 5(I).			$4 53/cy

6(K) *Gulf Placement with Beneficial Use at a New Placement Site* The dredged material would be used to create a submergent berm to absorb wave energy

(1) Mobilization and Demobilization
Mob and demob is same equipment as Alternative 5(I) = $237,000

(2) Pipelines L S. = N/A

(3) Dikes, Spillways and Ditches L.S. = N/A

(4) Dredging GIWW Stations 45+000 to 65+000. 699,612 pay cy

(a)	Dredging time for 12 cy clamshell is 167 days. The travel distance, light loading and draft restrictions are the same as Alternative 5(I). Additional time and positioning is required in order to place the material within the berm construction template.				
(b)	Daily cost for dredge, attendant plant, scows and towing vessels: $14,230/day @ 167 days		=	$2,376,410	
(c)	Overhead - 15%		=	356,462	
		Subtotal		$2,732,872	
(d)	Contingency - 12%		=	327,945	
(e)	Profit - 10%		=	273,287	
		Subtotal.		$3,334,104	
(f)	Bond - 0.5%		=	16,671	
(g)	Dredging Unit Price =	$4.79/cy			$3,350,775
		Total Alternative 6(K)			$3,587,775
		Total Unit Price 6(K).			$5 13/cy

7(L) *Open Bay Placement in a New Placement Area that has no Seagrass Beds:* Use cutterhead to remove shoal and place material by a bottom placement method to increase the elevation of the bay bottom to a level that would support seagrass growth.

(1) Mobilization and Demobilization

(a)	Mobilize dredge and attendant plant	=	$204,138	
(b)	Maximum subline 18,000' - 5,000' with dredge = 13,000 feet additional line. Assume no additional mob weld-up subline on jobsite			
(c)	Demobilize subline - Use 400 miles – 4MPH = 100 hours x $150/hr. x 2 tows	=	30,000	
(d)	50 hours light boat one-way, 2 trips 50 hours x $150/hr x 2 trips	=	15,000	
(e)	Total Mobilization and Demobilization	L.S		$249,138

(2) Pipelines

(a) Maximum pipeline 18,000' - 5,000' with dredge = 13,000 feet of additional line for alternative

(b) Install 8,000 feet of subline to start dredging 8,000 feet @ $5.00/ft. = $40,000

(c) Pick up 13,000 feet of line at completion. 13,000 feet @ $5 00/ft = 65,000

(d) Total Pipelines L S. $105,000

(3) Dikes, Spillways and Ditches L S. = -0-

(4) Dredging GIWW Stations 45+000 to 65+000 699,612 pay cy

(a)	Dredging time for dredge and attendant plant and spill barge is 34.2 days $15,475/day x 34 2 days	=	$529,245	
(b)	Spill barge $2,010/day @ 34 2 days	=	68,742	
(c)	13,000' subline x $2 00/ft./mo x 34.2 days − 30	=	29,640	
	Subtotal		$627,627	
(d)	Overhead - 15%	=	94,144	
	Subtotal		$721,771	
(e)	Contingency - 12%	=	86,613	
(f)	Profit - 10%	=	72,177	
	Subtotal		$880,561	
(g)	Bond - 0 5%	=	4,403	
(h)	Dredging Unit Price .= $1.26/cy			$ 884,964
	Total Alternative 7(L).			$1,239,102
	Total Unit Price 7(L):			$1 77/cy

8(M) *Beach Placement at an Existing Beach Placement Site by Pipeline* This alternative involves placement of the material removed from the shoal by cutterhead pipeline dredge to the beach north of the BIH entrance channel

(1) Mobilization and Demobilization

(a)	Mob and demob dredge and attendant plant	=	$204,138
(b)	Maximum subline 46,000' - 5,000' with dredge = 41,000 feet of additional line. Assume no mob line made upon jobsite.		
(c)	Demobilize line 400 miles − 4 MPH = 100 hours. 100 hours x $150/hr. x 4 tows	=	60,000
(d)	50 hours light boat one-way, 4 trips	=	30,000
(e)	Mobilize one additional booster 400 miles 150 hours (roundtrip) x $100/hr. (one tug)	=	15,000
(f)	Demobilize booster	=	15,000
(g)	Total Mobilization and Demobilization L S		$324,138

(2) Pipelines

(a) Maximum pipeline 46,000' - 5,000' with dredge = 41,000 feet of additional line for this alternative.

(b) Install 32,000 feet of line to start dredging
32,000 feet x $5.00/ft. = $160,000

(c) Pick up 41,000 feet of line at completion
41,000 feet x $5.00/ft. = 205,000

(d) Total Pipelines L.S. $365,000

(3) Dikes, Spillways and Ditches L S. = -0-

(4) Dredging GIWW Stations 45+000 to 65+000· 699,612 pay cy

(a) Dredging time for dredge, attendant plant and one booster is 36 5 days
Dredge = $15,475/day @ 36.5 days = $564,838
Booster = $ 5,720/day @ 36.5 days = 208,780

(b) Booster #2 for 19 4 days
Booster = $5,720/day @ 19.4 days = 110,968

(c) 41,000-foot line @ $2.00/ft /mo.
x 36.5 days ÷ 30 = 99,767
Subtotal: $984,353

(d) Overhead - 15% = 147,653
Subtotal: $1,132,006

(e) Contingency - 10% = 113,201

(f) Profit - 10% = 113,201
Subtotal: $1,358,408

(g) Bond - 0.5% = 6,792

(h) Dredging Unit Price = $2.04/cy $1,365,200
Total Alternative 8(M). $2,054,338
Total Unit Price $2 94/cy

9(N) *Beach Placement at a New Beach Placement Site by Pipeline:* This alternative involves placement of the material removed by cutterhead pipeline dredge to the beach on the east side of Padre Island immediately east of channel station 55+000.

(1) Mobilization and Demobilization

(a) Mob and demob dredge and attendant plant = $204,138

(b) Maximum subline 39,000' - 5,000' with dredge = 34,000 feet. Assume line delivered to site and fabricated on site. No mobilization.

(c) Demobilize line 400 miles – 4MPH = 100 hours
100 hours x $150/hr x 4 tows = 60,000

(d) 50 hours light boat one-way, 4 trips
50 hours x $150/hr. x 4 trips = 30,000

(e) Total Mobilization and Demobilization L S $294,138

(2) Pipelines

(a) Maximum pipeline 39,000' - 5,000' with dredge = 34,000 feet of additional line for this alternative

(b) Install 29,000 feet of line to start dredging
29,000 feet x $5.00/ft. = $145,000

(c) Pick up 34,000 feet of line at completion.
34,000 feet x $5.00/ft. = 170,000

(d) Total Pipelines L.S $315,000

(3) Dikes, Spillways and Ditches L.S. = -0-

(4) Dredging GIWW Stations 45+000 to 65+000· 699,612 pay cy

(a) Dredging time for dredge, attendant plant and one booster is 34.2 days
Dredge $15,475/day @ 34.2 days = $529,245
Booster #1 $5,720/day @ 34.2 days = 195,624

(b) 34,000 feet of line x $2.00/ft /mo.
x 34.2 days ÷ 30 = 77,520
Subtotal: $ 802,389

(c) Overhead - 15% = 120,358
Subtotal. $ 922,747

(d) Contingency - 10% = 92,275

(e) Profit - 10% = 92,275
Subtotal. $1,107,297

(f) Bond - 0 5% = 5,536

(g) Dredging Unit Price = $1 59/cy $1,112,833
Total Alternative 9(N) $1,721,971
Total Unit Price 9(N) $2.46/cy

10(O) *Upland Placement Site on Padre Island.* This alternative involves placement of material from the shoal by cutterhead pipeline dredge to a new confined placement area on Padre Island immediately east of channel station 55+000.

(1) Mobilization and Demobilization

(a) Dredge and attendant plant = $204,138

(b) Maximum subline 35,000'- 5,000' with dredge = 30,000 feet Assume line delivered to site and fabricated on site. No mobilization.

(c) Demobilize line 400 miles -- 4 MPH = 100 hours.
100 hours x $150/hr x 3 tows = 45,000

(d) 50 hours light boat one-way, 3 trips
50 hours x $150/hr x 3 trips = 22,500

(e) Total Mobilization and Demobilization L S. $271,638

(2) Pipelines

(a)	Maximum line 35,000' - 5,000' with dredge = 30,000 feet of additional line for this alternative.			
(b)	Install 25,000 feet of line to start dredging 25,000 feet x $5.00/ft.	=	$125,000	
(c)	Pick up 30,000 feet of line at completion. 30,000 feet x $5.00/ft	=	150,000	
(d)	Total Pipelines	L S.		$275,000

(3) Dikes, Spillways and Ditches

(a)	Build 12,400 lineal feet of 7-foot high retaining dike. Use 10-foot crown and 3 on 1 side slopes = 124,600 cubic yards gross 124,600 cubic yards @ $1.25/cy	=	$155,750	
(b)	Construct new spillway L S.	=	35,000	
(c)	Install visqueen on inside dike slope 12,400 feet @ $3.50/ft	=	43,400	
(d)	Mob and demob (subcontractor)	=	50,000	
(e)	Prime contractor services - 5%	=	14,208	
(f)	Total Dikes, Spillways and Ditches	L.S.		$298,358

(4) Dredging GIWW Station 45+000 to 65+000· 699,612 pay cy

(a)	Dredging time for dredge, attendant plant and one booster is 34 2 days				
	Dredge $15,475/day x 34.2 days	=	$ 529,245		
	Booster #1 $5,720/day x 34.2 days	=	195,624		
(b)	30,000-foot line x $2.00/ft./mo x 34 2 days – 30	=	68,400		
	Subtotal.		$ 793,269		
(c)	Overhead - 15%	=	118,990		
	Subtotal:		$ 912,259		
(d)	Contingency - 10%	=	91,226		
(e)	Profit - 10%	=	91,226		
	Subtotal:		$1,094,711		
(f)	Bond - 0 5%	=	5,474		
(g)	Dredging Unit Price =	$1.57/cy			$1,100,185
		Total Alternative 10(O)·			$1,945,181
		Total Unit Price 10(O).			$2.78/cy

11(Q) *Upland Placement at Placement Area 241·* This alternative involves the most economical of two methods one by cutterhead pipeline dredge and pumping into Placement Area 241, and the other by clamshell dredging into scows and pumping out at Placement 241 After considerable investigation, it was determined that cutterhead pipeline dredging would be the more cost-effective method

(1) Mobilization and Demobilization

(a)	Mob and demob dredge and attendant plant	=	$204,138	
(b)	Maximum subline 65,000' - 5,000' with dredge = 60,000 feet of additional line for this alternate Pipe will be delivered to site and assembled, therefore additional mobilization			
(c)	Demobilize 60,000 feet of subline· Use 400 miles – 4 MPH = 100 hrs/tow x 6 tows· 100 hours x $150/hr x 6 tows	=	90,000	
(d)	50 hours x $150/hr x 6 trips	=	45,000	
(e)	Mobilize 2 ea boosters 400 miles - use 150 hrs (roundtrip) x $100/hr (1 tug) x 2 ea	=	30,000	
(f)	Demobilize 2 ea boosters	=	30,000	
(g)	Total Mobilization and Demobilization	L.S		$399,138

(2) Pipelines

(a)	Maximum pipeline 65,000' - 5,000' with dredge = 60,000 feet of additional line for this alternative			
(b)	Install 45,000 feet of subline to start dredging 45,000' x $5.00/ft.	=	$225,000	
(c)	Pick up 60,000 feet of line at completion 60,000' x $5.00/ft.	=	300,000	
(d)	Total Pipelines	L S		$525,000

(3) Dikes, Spillways and Ditches

(a)	Placement Area 241. Construct 4,650 feet of new dike and repair 9,750 feet of dike 6-foot dike height with 10-foot crown and 3 on 1 side slopes = 112,000 cy gross 112,000 cy (gross) x $1.35/cy	=	$151,200	
(b)	Spillway (minor repair) L S.	=	2,000	
(c)	No visqueen required	=	-0-	
(d)	Mob and demob (subcontractor)	=	50,000	
(e)	Prime contractor services - 5%	=	10,160	
(f)	Total Dikes, Spillways and Ditches	L.S		$213,360

(4) Dredging GIWW Stations 45+000 to 65+000: 699,612 pay cy

(a)	Dredging time with dredge and 2 boosters 44 8 days			
	Dredge $15,475/day x 44 8 days	=	$693,280	
	Booster (1&2) $5,720/day x 44.8 days x 2 ea	=	512,512	
(b)	Add Booster #3 for 24.0 days			
	Booster (#3) $5,720/day x 24 0 days	=	137,280	
(c)	60,000 feet subline x $2 00/ft/month x 44.8 days – 30	=	179,200	
	Subtotal:		$1,522,272	
(d)	Overhead - 15%	=	228,341	
	Subtotal		$1,750,613	

(e)	Contingency - 12%			=	210,074	
(f)	Profit - 10%			=	175,061	
			Subtotal.		$2,135,748	
(g)	Bond - 0 5%			=	10,679	
(h)	Dredging Unit Price	=	$3.07/cy			$2,146,427
			Total Alternative 11(Q):			$3,283,925
			Total Unit Price 11(Q):			$4.69/cy

12(R) *Upland Placement Site at South End of Long Island·* This alternative is similar to Alternative 11(Q), but uses a new placement area The most economical method of dredging will be by cutterhead pipeline dredge.

(1)	Mobilization and Demobilization - same as 11(Q)			L S.	=	$399,138
(2)	Pipelines - same as 11(Q)			L S.	=	$525,000
(3)	Dikes, Spillways and Ditches					
(a)	New Placement Area on Long Island: 12,360 feet of 7-foot dike height with a 10-foot crown and 3 on 1 side slopes 124,200 cy (gross) x $1.35/cy		=	$167,670		
(b)	Construct 1 New Spillway	L.S	=	$35,000		
(c)	No visqueen required		=	-0-		
(d)	Mob and Demob (subcontractor)	L.S.	=	$50,000		
(e)	Prime contractor services - 5%		=	$12,630		
(f)	Total Dikes, Spillways and Ditches	L.S.				$265,300
(4)	Dredging GIWW Stations 45+000 to 65+000 - 699,612 cy					
(a)	Dredging Unit Price =	$3 07/cy				$2,146,427
		Total Alternative 12(R):				$3,335,865
		Total Unit Price 12(R)				$4.77/cy

13(S) *Upland Placement Site at a New Mainland Site:* This alternative calls for the shoal to be maintained using a cutterhead dredge with placement in a new placement area at a development area in Holly Beach.

(1)	Mobilization and Demobilization			
(a)	Mob and demob dredge and attendant plant	=	$204,138	
(b)	Maximum subline 31,000' - 5,000' with dredge = 26,000 feet of additional line for this alternate. Pipe will be delivered to site and assembled, therefore no additional mobilization.			
(c)	Demobilize 26,000 feet of subline, 400 miles – 4MPH 100 hours x $150/hr x 3 tows	=	45,000	

	(d)	50 hours light boat one-way: 3 trips				
		50 hours x $150/hr. x 3 trips		=	22,500	
	(e)	Total Mobilization and Demobilization	L S.			$271,638
(2)	Pipelines					
	(a)	Maximum pipeline 31,000' - 5,000' with dredge				
		= 26,000 feet of additional line with this alternative				
	(b)	Install 21,000 feet of line to start dredging				
		21,000 feet x $5 00/ft.		=	$105,000	
	(c)	Pick up 26,000 feet of line at completion				
		26,000 feet x $5 00/ft.		=	130,000	
	(d)	Total Pipelines	L.S			$235,000
(3)	Dikes, Spillways and Ditches					
	(a)	Construct new placement area at Holly Beach. 12,400 lineal feet				
		of 7-foot high dike with 10-foot crown and 3 on 1 side slopes.				
		124,600 cy (gross) x $1 35/cy		=	$168,210	
	(b)	Construct one new spillway	L.S.	=	35,000	
	(c)	No visqueen required		=	-0-	
	(d)	Mob and demob (subcontractor)		=	50,000	
	(e)	Prime contractor services - 5%		=	12,660	
	(f)	Total Dikes, Spillways and Ditches	L S.			$265,870
(4)	Dredging GIWW Stations 45+000 to 65+000. 699,612 pay cy					
	(a)	Dredging time with dredge and one booster 32 2 days				
		Dredge $15,475/day x 32.2 days		=	$498,295	
		Booster #11 $5,720/day x 32 2 days		=	184,184	
	(b)	26,000 feet subline x $2 00/ft./month				
		x 32.2 days − 30		=	55,813	
			Subtotal.		$738,292	
	(c)	Overhead - 15%		=	110,744	
			Subtotal		$849,036	
	(d)	Contingency - 10%		=	84,904	
	(e)	Profit - 10%		=	84,904	
			Subtotal		$1,018,844	
	(f)	Bond - 0.5%			5,094	
	(g)	Dredging Unit Price =	$1.46/cy			$1,023,938
			Total Alternative 13(S)			$1,796,446
			Total Unit Price 13(S).			$2.57/cy

4.0 Operating and Ownership Cost

4.1 24" or 27" Hydraulic Cutterhead Dredge - 4000 HP

Daily Labor Cost:

Dredge	Crew Count	Weekly Payroll
24"	40	$25,208
27"	41	28,343
27"	42	25,874

Average Weekly Payroll	=	$26,475	per week
Average Weekly Crew Count	=	41	emp/wk
Payroll Insurance and Taxes at 45% x 26,475/week	=	$38,389	per week
Total Daily Labor Cost	=	$5,484	per day

Daily Dredge Cost:

(1)	Labor (total dredge crew. 41 employees)		=	$ 5,484	per day
(2)	Fuel: 3700 gallons/day @ $0.75/gallon		=	2,775	per day
(3)	Oil and Grease		=	225	per day
(4)	Supplies $25,000/mo – 30 days		=	833	per day
(5)	Deprec. Dredge $60,000/mo ÷ 30 days		=	2,000	per day
(6)	Repairs $100/hr x 16.5 hours/day average		=	1,650	per day
(7)	Attendant Plant Cost.				
	(a) 3 ea tenders @ $300/day		=	900	per day
	(b) 1 ea crane and barge @ $400/day		=	400	per day
	(c) 1 ea derrick barge @ $250/day		=	250	per day
	(d) 3 ea deck barges @ $100/day		=	300	per day
	(e) 1 ea survey boat @ $125/day		=	125	per day
	(f) 1 ea D-4 Dozer @ $200/day		=	200	per day
	(g) pipe (5000' w/dredge) x $2.00/ft/mo	– 30	=	333	per day
		Total Cost.		$15,475	per day

4.2 24" or 27" Booster 3600 to 4000 HP

Daily Booster Cost:

(1)	Labor: 6 each @ $135/day		=	$ 810	per day
(2)	Fuel. 2800 gallons/day @ $0 75/gallon		=	2,100	per day
(3)	Oil and Grease		=	210	per day
(4)	Supplies $12,000/month – 30 days		=	400	per day
(5)	Depreciation $42,000/mo – 30 days		=	1,400	per day
(6)	Repairs $50 00/hr x 16 hours/day		=	800	per day
		Total Cost		$5,720	per day

4.3 Spill Barge with Diffuser

Daily Spill Barge Cost:

(1)	Labor: 6 each @ $135/day	=	$ 810	per day
(2)	Fuel: Oil and Grease (from dredge)	=	-0-	

(3)	Barge Rental	=	150	per day
(4)	4 Drum Hoists for Anchor Lines	=	200	per day
(5)	Electronic Positioning Equipment	=	200	per day
(6)	Construct and Install Spill Barge, Pipe and Diffuser	=	450	per day
(7)	Supplies	=	200	per day
		Total Cost	$2,010	per day

4.4 Bucket Dredge and Scows (12-Cubic-Yard Bucket Dredge)

Daily Cost:

(1)	12 cy Clamshell Bucket Daily Rate	=	$ 5,000	per day
(2)	4000 cy Bottom Dump Scow	=	1,200	per day
(3)	4000 cy Bottom Dump Scow	=	1,200	per day
(4)	2000 cy Bottom Dump Scow	=	800	per day
(5)	2000 cy Bottom Dump Scow	=	800	per day
(6)	2400 HP Towing Vessel	=	2,350	per day
(7)	2400 HP Towing Vessel	=	2,340	per day
(8)	600 HP Tender Boat	=	530	per day
		Total Cost	$14,230	per day

4.5 Subline Pipeline Cost

(1)	24" or 27" Line, 500-Foot Section		
(2)	500' x 1/2" Wall Thickness @ $40/foot	=	$20,000
(3)	Set of Ball and Bells (24" or 27")	=	6,000
(4)	Labor and equipment to unload, handle and weld 10 each joints of pipe @ $300/each	=	3,000
(5)	Weld one each set of balls and bells to subline 2 each welds @ $500/each	=	1,000
	Total Cost 500-Foot Section		$30,000

(6) Estimated life of submerged pipeline due to use, mobilization and demobilization, and handling is 5 years.

(7) Approximate use per year of subline is 50% or 6 months per year.

(8) Total pipeline usage is 5 years @ 6 per year: 30 months.

(9) Depreciated cost of pipeline per month
$30,000/Section ÷ 30 Months ÷ 500'/Section = $2.00/ft./mo.

5.0 Upland Placement Sites

5.1 Placement Area No. 241: 295 Acres = 475,900 cy/ft

Fill Quantity 874,500 cy (gross) ÷ 475,900 cy/ft	=	1 9'	fill
Use bulk factor of 1.4 x gross quantity	=	0.8'	fill
Freeboard for Placement Area 2' to 3' (use 3')	=	3.0'	fb
Required Dike Height	=	5.7'	height

Use 6-foot Dike Height with 10-foot Crown and 1 on 3 Side Slopes:

New Dike Requirement	=	4,650	feet
Repair Existing Dike	=	9,750	feet
Total.		14,400	feet
6-Foot Dike (18+10) x 6' – 27 x 14,400 feet	=	89,600	cy (net)
Use 25% for semicompaction and overbuild	=	112,000	cy (gross)

Minor repairs to existing spillway.

5.2 Long Island Placement Area: 200 Acres = 322,700 cy/ft

Fill Quantity 874,500 cy (gross) ÷ 322,700 cy/ft	=	2.7'	fill
Use bulk factor of 1 4 x gross quantity	=	1 1'	fill
Freeboard for Placement Area 2' to 3' (use 3')	=	3.0'	fb
Required Dike Height	=	6.8'	height

Use 7-foot Dike Height with 10-foot Crown and 1 on 3 Side Slopes

New Dike Requirement	=	12,360	feet
7-foot Dike (21+10) x 7' ÷ 27 x 12,360 feet	=	99,340	cy (net)
Use 25% for semicompaction and overbuild	=	124,200	cy (gross)

Will be required to construct and install one new spillway in the Placement Area

5.3 Padre Island Placement Area: 180 Acres = 293,300 cy/ft

Fill Quantity 874,500 cy (gross) ÷ 293,300 cy/ft	=	3 0'	fill
Use bulk factor of 1 4 x gross quantity	=	1 2'	fill
Freeboard for Placement Area 2' to 3' (use 2 8')	=	2.8'	height
Required Dike Height	=	7.0'	height

Use 7-foot Dike Height with 10-foot Crown and 1 on 3 Side Slopes

New Dike Requirement	=	12,400	feet
7-foot Dike = (21+10) x 7 0 ÷ 27 x 12,400 feet	=	99,700	cy (net)
Use 25% for semicompaction and overbuild	=	124,600	cy (gross)

Will require one new spillway for placement area.

Will require visqueen around the total inside slope of the dike - 12,400 feet.

5.4 Holly Beach Placement Area: 180 Acres = 293,300 cy/ft

Fill Quantity 874,500 cy (gross) ÷ 293,300 cy/ft	=	3 0'	fill
Use bulk factor of 1.4 x gross quantity	=	1 2'	fill
Freeboard for Placement Area 2' to 3' (use 2 8')	=	2.8'	height
Required Dike Height	=	7.0'	height

Use 7-foot Dike with 10-foot Crown and 1 on 3 Side Slopes

New Dike Requirement	=	12,400	feet
Use 25% for semicompaction and overbuild	=	124,600	cy (gross)

Will require one new spillway for placement area

No visqueen required for these dikes.

6.0 Conclusions and Recommendations

6.1 Conclusions:

There should be equipment available to bid on the project. Since there are more cutterhead pipeline dredges and cutterhead work on the Gulf Coast, a scenario which included cutterhead dredges would draw the most competition. Alternatives that require pipeline lengths greater than 25,000 to 30,000 feet tend to reduce some of the competition Some of the small dredging contractors do not keep a large pipeline inventory and would not make that kind of investment for a short job. It will be more difficult to obtain a clamshell bid There are some clamshell dredges on the Gulf Coast but only a very few bottom dump scow barges. Bottom dump barges needed for this work may have to be mobilized from the Atlantic Coast.

6.2 Recommendations:

The current method 1(A) is the most cost-effective dredging solution to the shoal. This is due primarily to the short pumping distance (less than 2000 feet) and easy access to the placement sites. Three other methods 2(B), 4(D) and 7(L) are all essentially equal in cost The total unit cost varies five to ten cents a cubic yard, but for all practical purposes, they can be considered equal. These alternatives may have to be reviewed on their merit more so than their cost-effectiveness. There are five other alternatives 3(C), 8(M), 9(N), 10(Q) and 13(S) that fall into another level of costs. Again, these unit costs could be closer together depending on one particular contractor's approach to the work. The four remaining alternatives would rank last from a relative cost-effective standpoint. These alternatives are 5(I), 6(K), 11(Q) and 12(R). Several of the alternatives envision using this material for beach fill and underwater berm construction The lack of sand in the material to be dredged raises compatibility issues with respect to the native beach sands The basic data utilized for this report should be confirmed by additional geotechnical and hydrographic data prior to using the material for beach fill or underwater berm construction.

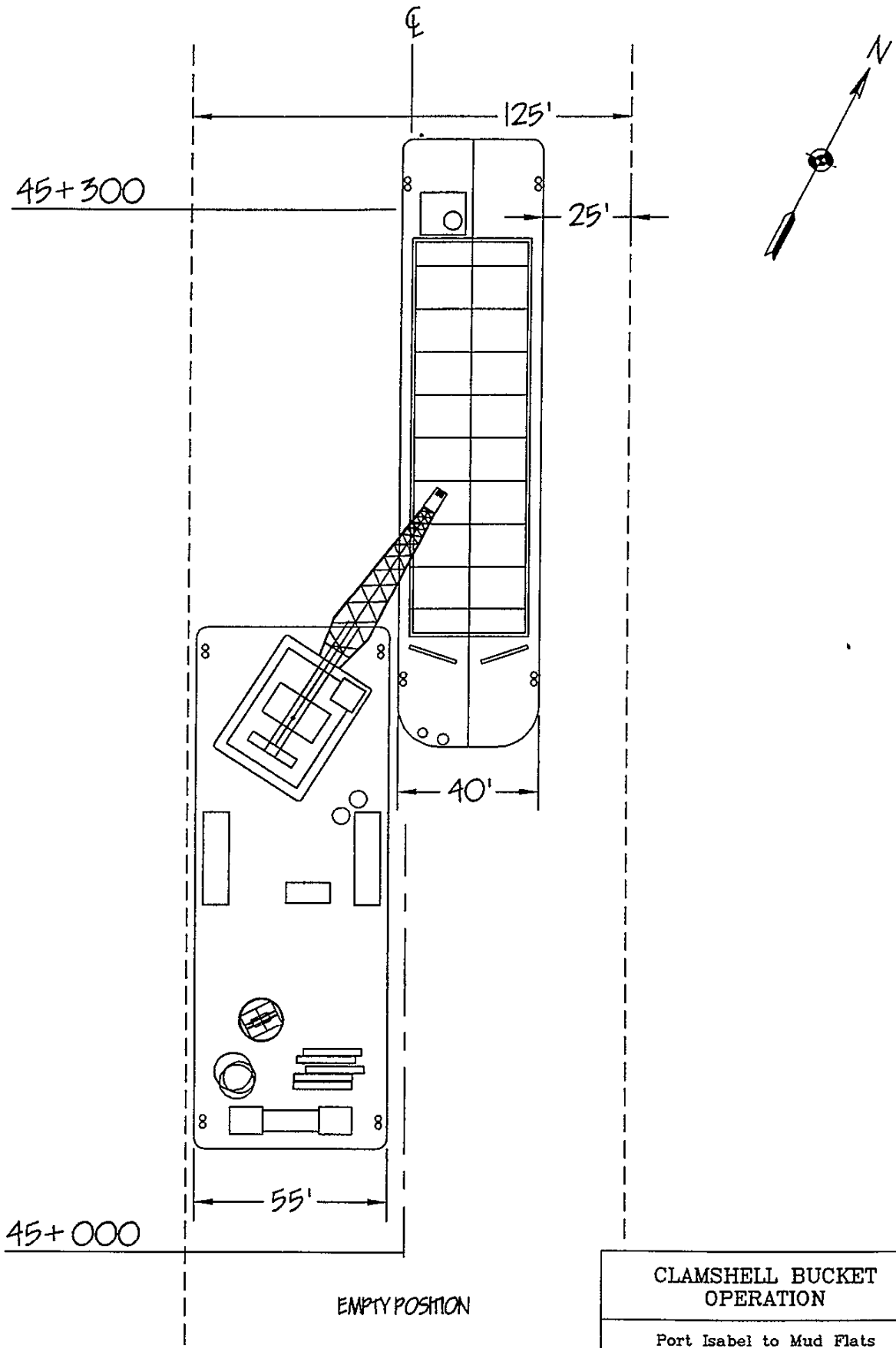
Table 2

Dredge Volume Calculations

Date Surveyed: April 18, 1997

Line Station No.	Dist Interval (FT)	Remaining Depth End Area (SF)	Remaining Depth Int Vol. (CY)	Remaining Depth Tot. Vol. (CY)	Overdepth End Area (SF)	Overdepth Int. Vol. (CY)	Overdepth Tot. Vol. (CY)	Total Pay Vol. (CY)
45+000	0	687 4	0	0	250.0	0	0	0
45+500	500	699.8	12,844	12,844	250.0	4,629	4,629	17,474
46+000	500	739.0	13,322	26,167	250 0	4,629	9,259	35,427
46+500	500	715 2	13,466	39,633	250 0	4,629	13,888	53,522
47+000	500	703 8	13,140	52,774	250.0	4,629	18,518	71,292
47+500	500	681 8	12,830	65,604	250 0	4,629	23,148	88,752
48+000	500	598 8	11,857	77,462	250.0	4,629	27,777	105,240
48+500	500	549 6	10,634	88,096	250 0	4,629	32,407	120,504
49+000	500	516 7	9,874	97,971	250 0	4,629	37,037	135,008
49+500	500	562 9	9,996	107,967	250.0	4,629	41,666	149,634
50+000	500	512 4	9,957	117,925	250.0	4,629	46,296	164,221
50+500	500	571 5	10,037	127,963	250 0	4,629	50,925	178,889
51+000	500	523 0	10,135	138,098	250 0	4,629	55,555	193,654
51+500	500	585 3	10,262	148,360	250 0	4,629	60,185	208,546
52+000	500	628 7	11,241	159,602	250 0	4,629	64,814	224,417
52+500	500	611 0	11,480	171,082	250 0	4,629	69,444	240,527
53+000	500	630 9	11,500	182,582	250.0	4,629	74,074	256 656
53+500	500	610 5	11,495	194,078	250 0	4,629	78,703	272,781
54+000	500	649 9	11,671	205,749	250.0	4,629	83,333	289,083
55+000	1,000	667 7	24,402	230,152	250 0	9,259	92,592	322,744
55+500	500	684 1	12,517	242,669	250 0	4,629	97,222	339,891
56+000	500	713 4	12,940	255,610	250 0	4,629	101,851	357,461
56+500	500	717 3	13,247	268,857	250 0	4,629	106,481	375,338
57+000	500	757 6	13,657	282,514	250 0	4,629	111,111	393,625
57+500	500	746 2	13,924	296,439	250 0	4,629	115,740	412,180
58+000	500	773 7	14,073	310,513	250 0	4,629	120,370	430,883
58+500	500	780 3	13,926	324,439	250 0	4,629	125,000	449,439
59+000	500	718 0	13,400	337,840	250 0	4,629	129,629	467,469
59+176	176	738.5	4,749	342,589	250 0	1,631	131,261	473,850
59+500	324	753 1	8,943	351,532	250 0	2,997	134,259	485,791
60+000	500	773 1	14,131	365,664	250 0	4,629	138,888	504,552
61+000	1,000	804 1	29,208	394,872	250 0	9,259	148,148	543,020
61+500	500	766 8	14,546	409,418	250 0	4,629	152,777	562,196
62+000	500	806 5	14,569	423,987	250 0	4,629	157,407	581,395
62+500	500	801 3	14,888	438,876	250 0	4,629	162,037	600,913
63+000	500	847 0	15,263	454,139	250 0	4,629	166,666	620,806
63+500	500	845 2	15,670	469,809	250 0	4,629	171,296	641,105
64+500	1,000	794 7	30,370	500,180	250.0	9,259	180,555	680,735
65+000	500	743 9	14,247	514,427	250 0	4,629	185,185	699 612

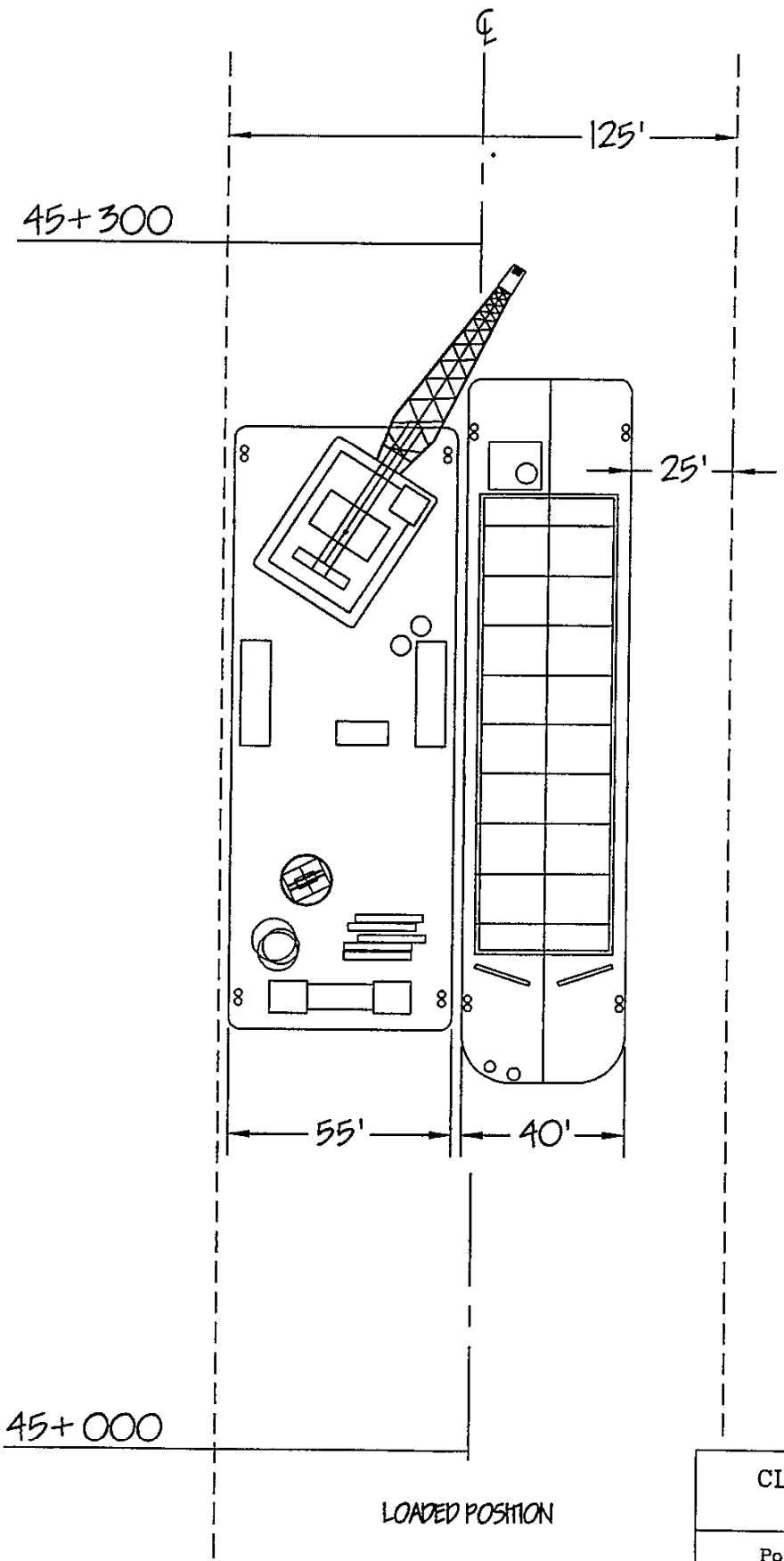
Total Pay Volume: 699,612



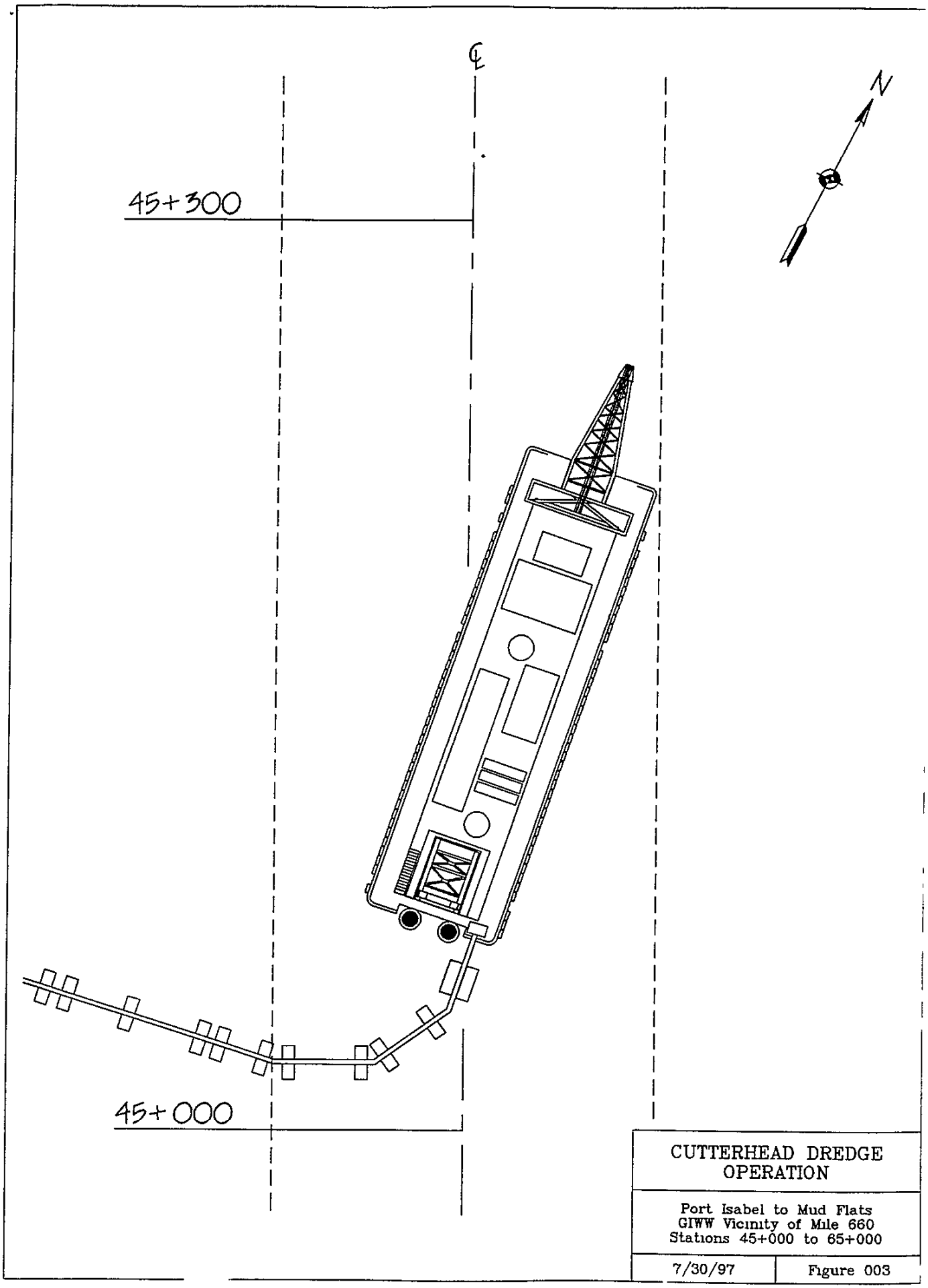
CLAMSHELL BUCKET OPERATION

Port Isabel to Mud Flats
GIWW Vicinity of Mile 660
Stations 45+000 to 65+000

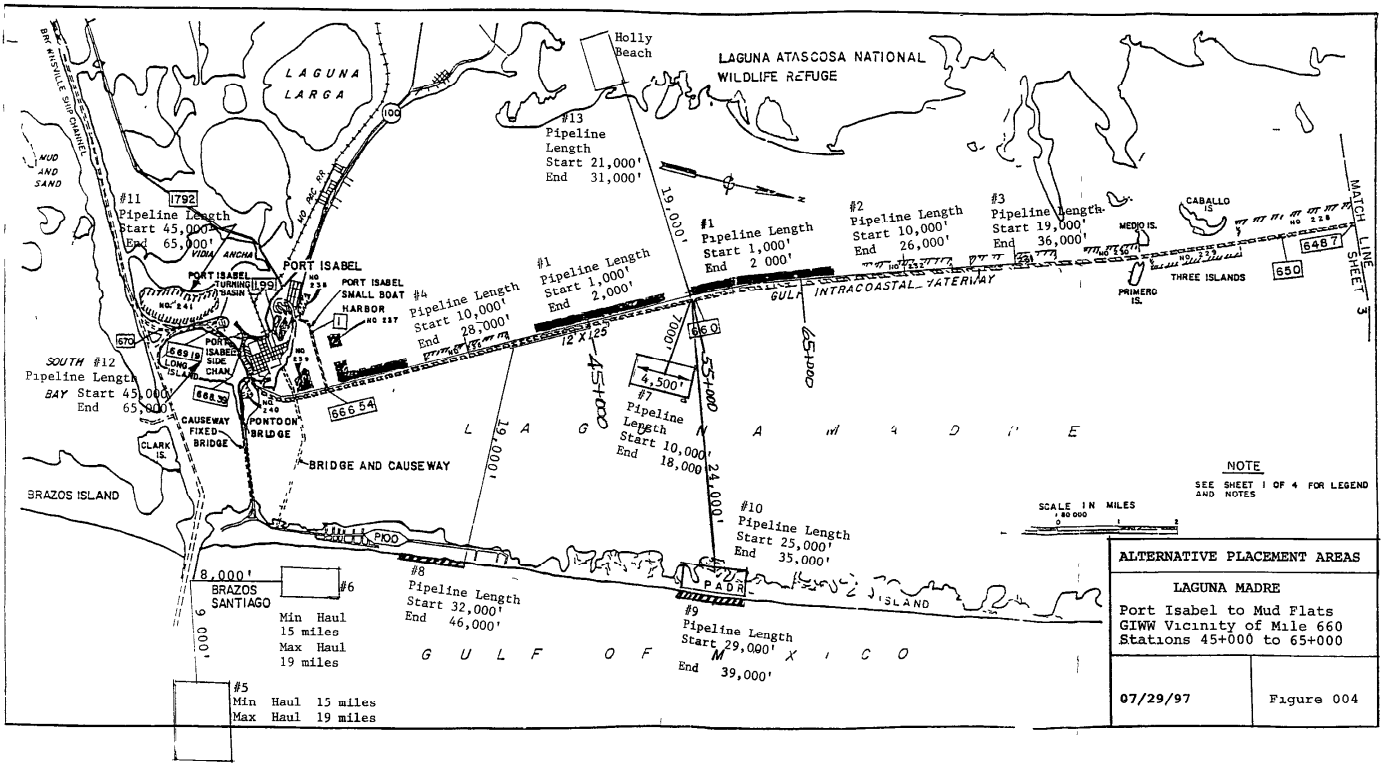
7/29/97	Figure 001



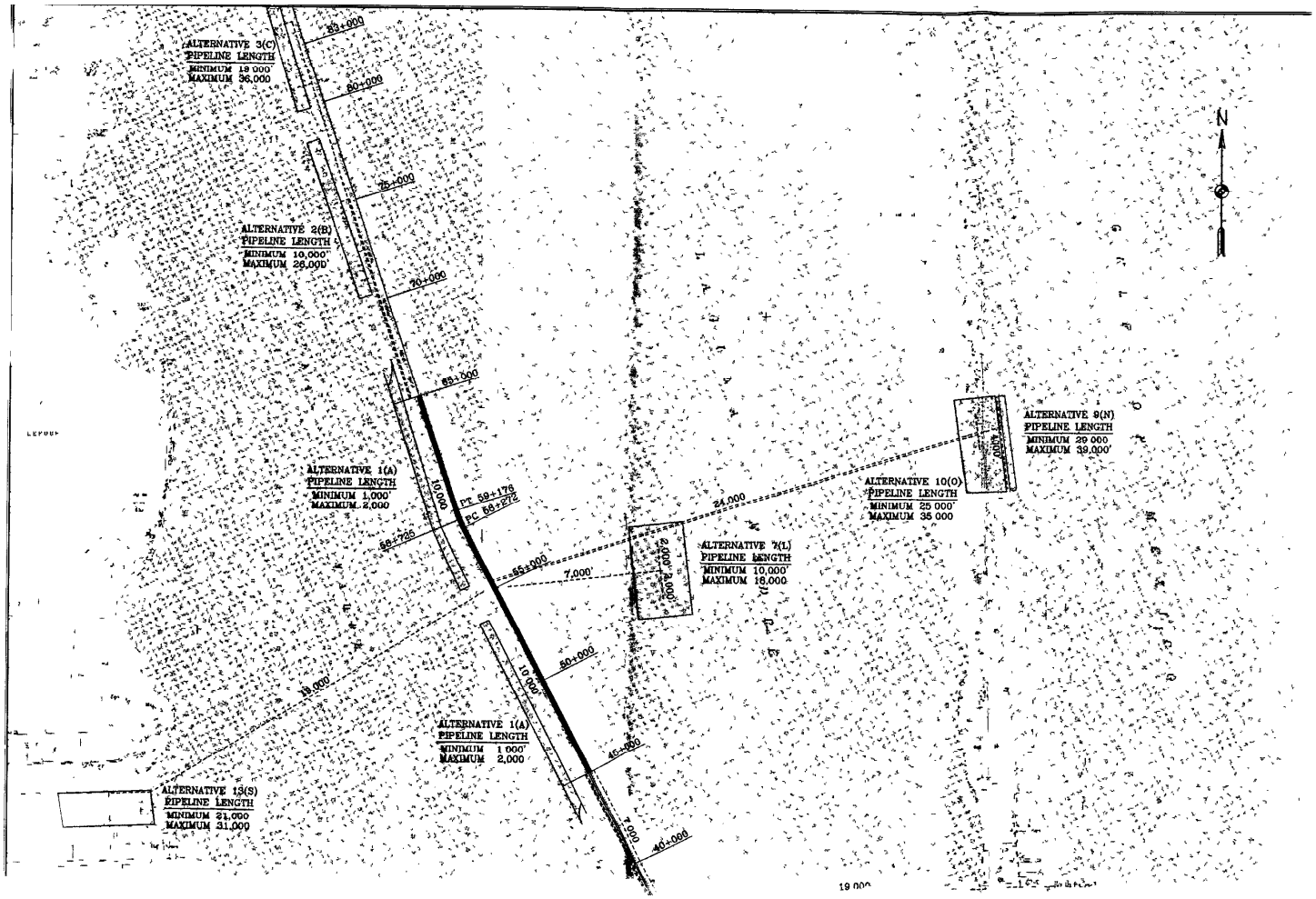
CLAMSHELL BUCKET OPERATION	
Port Isabel to Mud Flats GIWW Vicinity of Mile 660 Stations 45+000 to 65+000	
7/29/97	Figure 002

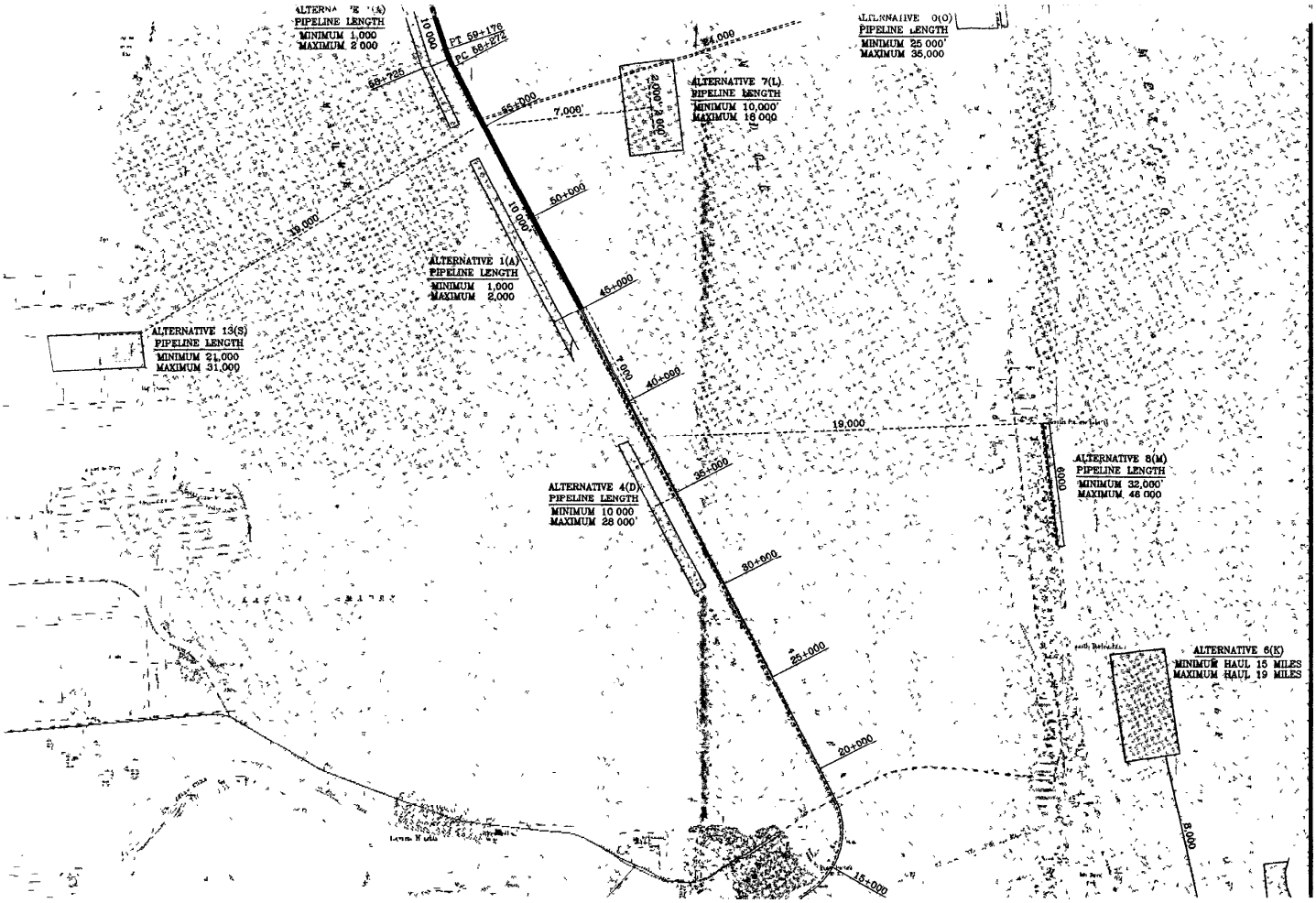


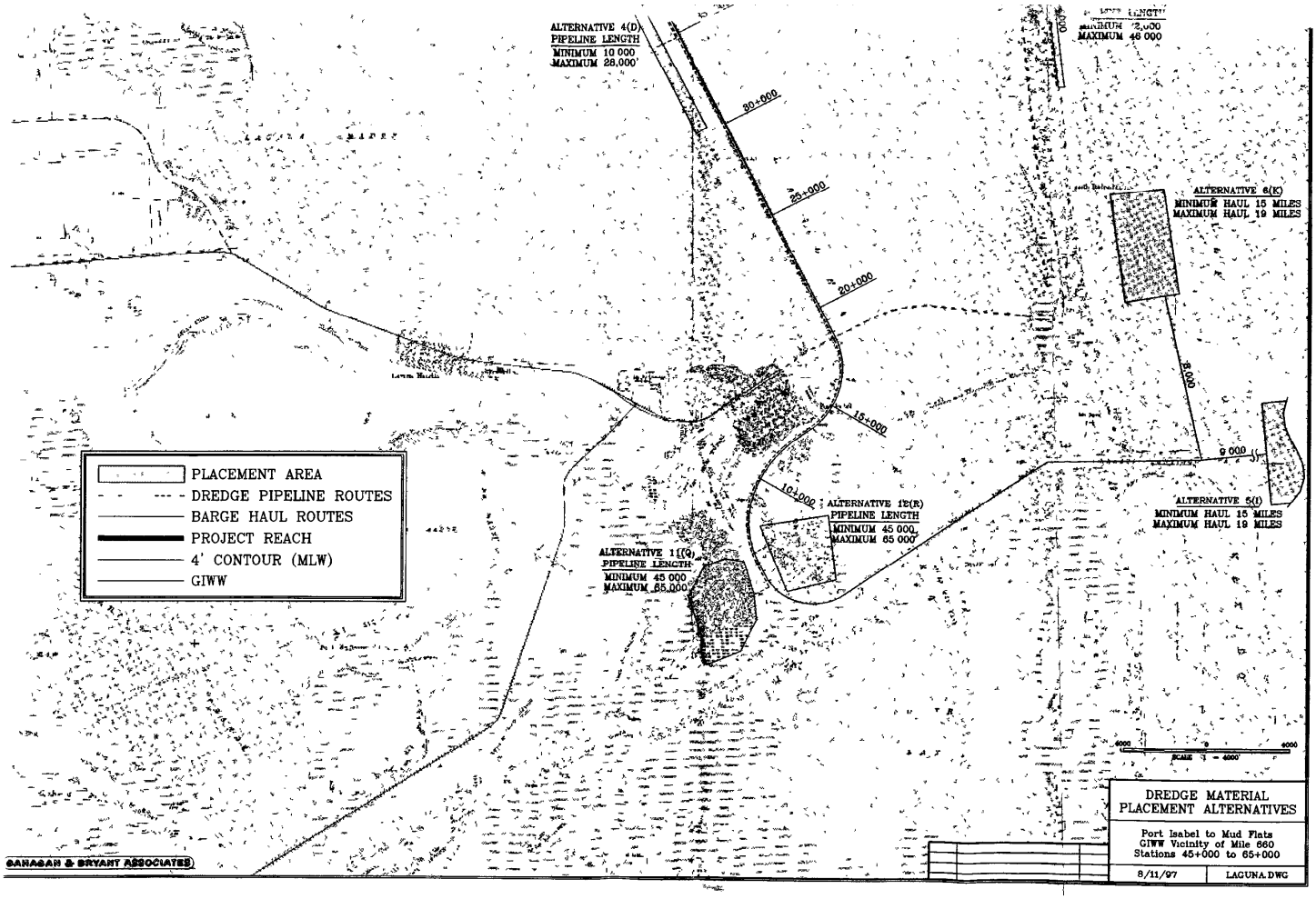
CUTTERHEAD DREDGE OPERATION	
Port Isabel to Mud Flats GIWW Vicinity of Mile 660 Stations 45+000 to 65+000	
7/30/97	Figure 003



ALTERNATIVE PLACEMENT AREAS	
LAGUNA MADRE Port Isabel to Mud Flats GIWW Vicinity of Mile 660 Stations 45+000 to 65+000	
07/29/97	Figure 004


ALTERNATIVE 3(C)
PIPELINE LENGTH
MINIMUM 19 000'
MAXIMUM 36,000'
85+000
80+000
75+000
ALTERNATIVE 2(B)
PIPELINE LENGTH
MINIMUM 10,000'
MAXIMUM 26,000'
70+000
65+000
ALTERNATIVE 1(A)
PIPELINE LENGTH
MINIMUM 1,000'
MAXIMUM 2,000'
PT 59+176
PC 58+276
10,000'
58+726
55+000
7,000'
19,000'
50+000
10,000'
ALTERNATIVE 1(A)
PIPELINE LENGTH
MINIMUM 1,000'
MAXIMUM 2,000'
45+000
40+000
ALTERNATIVE 13(S)
PIPELINE LENGTH
MINIMUM 21,000
MAXIMUM 31,000
24,000'
2,000'
2,000'
ALTERNATIVE 7(L)
PIPELINE LENGTH
MINIMUM 10,000'
MAXIMUM 16,000
ALTERNATIVE 10(O)
PIPELINE LENGTH
MINIMUM 25 000'
MAXIMUM 35 000
ALTERNATIVE 9(N)
PIPELINE LENGTH
MINIMUM 29 000
MAXIMUM 39,000'
N
19 000


ALTERNATIVE 2(S)
PIPELINE LENGTH
MINIMUM 1,000
MAXIMUM 2,000
PT 59+176
PC 58+872
58+725
10,000
55+000
7,000'
24,000
ALTERNATIVE 7(L)
PIPELINE LENGTH
MINIMUM 10,000'
MAXIMUM 18,000
2,000'
10,000'
50+000
45+000
40+000
ALTERNATIVE 1(A)
PIPELINE LENGTH
MINIMUM 1,000
MAXIMUM 2,000
19,000
ALTERNATIVE 13(S)
PIPELINE LENGTH
MINIMUM 21,000
MAXIMUM 31,000
ALTERNATIVE 4(D)
PIPELINE LENGTH
MINIMUM 10 000
MAXIMUM 28 000'
35+000
30+000
25+000
20+000
15+000
ALTERNATIVE 0(O)
PIPELINE LENGTH
MINIMUM 25 000'
MAXIMUM 35,000
19,000
6000
ALTERNATIVE 8(M)
PIPELINE LENGTH
MINIMUM 32,000'
MAXIMUM 46 000
ALTERNATIVE 6(K)
MINIMUM HAUL 15 MILES
MAXIMUM HAUL 19 MILES
8,000


ALTERNATIVE 4(D)
PIPELINE LENGTH
MINIMUM 10 000'
MAXIMUM 28,000'
30+000
25+000
20+000
15+000
10+000
5+000
ALTERNATIVE 6(E)
MINIMUM HAUL 15 MILES
MAXIMUM HAUL 19 MILES
3,000
9 000
ALTERNATIVE 5(I)
MINIMUM HAUL 15 MILES
MAXIMUM HAUL 19 MILES
ALTERNATIVE 1E(R)
PIPELINE LENGTH
MINIMUM 45 000'
MAXIMUM 65 000'
ALTERNATIVE 1(G)
PIPELINE LENGTH
MINIMUM 45 000'
MAXIMUM 65,000'
PLACEMENT AREA
DREDGE PIPELINE ROUTES
BARGE HAUL ROUTES
PROJECT REACH
4' CONTOUR (MLW)
GIWW
4000 0 4000
SCALE 1" = 4000'
DREDGE MATERIAL
PLACEMENT ALTERNATIVES
Port Isabel to Mud Flats
GIWW Vicinity of Mile 660
Stations 45+000 to 65+000
8/11/97
LAGUNA.DWG
GANAGAN & BRYANT ASSOCIATES